**Vertical 6. I-Corps**

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| **Deliverables:**   1. **An “elevator pitch,” which provides highlights of the content, such as why the approach is important, how it works, and examples of where it has worked** 2. **A short, digestible summary of underlying premises and rationales, supported by research (i.e., not a report)** 3. **Profiles of major categories of candidate users, including specific examples of when, and under what circumstances, the approach may be employed, supported by research into the target audience and their needs** 4. **One or more “success stories” or other learning narratives that highlight the impact of and justification for using this approach.** 5. **Documentation of challenges to deployment, and potential limitations of the approach, including barriers or obstacles encountered within agencies employing the approach** 6. **A “How-To” document, detailing key steps for deploying the approach, including promising practices in adaptation and deployment** 7. **An online inventory of resources** 8. **Examples of policy (e.g. legislation, Executive Order, etc.) that have enabled or encouraged the approach** 9. **Future directions (next practices as opposed to best practices)** |

**Pull quotes [[use to accentuate text on website]]:**

“Sometimes, it’s easy for us to get caught up in the research and not think about how the commercial impact of our science and technology can actually impact lives. Lab-Corps showed me how I can maximize the benefit of my basic research […] to create technology that has real-world commercial impacts for Americans.” Ralph Muehleisen, a researcher from Argonne National Laboratory and a graduate of Lab-Corps

### **Deliverable 1: Elevator pitch summary**

**Intro**

Developed in 2011 by the National Science Foundation (NSF), NSF Innovation Corps (I-Corps™) (hereafter [I-Corps](https://www.nsf.gov/news/special_reports/i-corps/about.jsp)) provides experiential entrepreneurship training to [teams](https://www.nsf.gov/news/special_reports/i-corps/teams.jsp) of Federally-funded researchers. I-Corps was developed to better prepare academic researchers for commercialization of federally funded research. [Grose, T. K., “[To Market, to Market](http://www.asee-prism.org/to-market-to-market-dec/)”, ASEE Prism, December 2014]. I-Corps offers an evidence-based framework to support research commercialization.  The rigorous “boot camp” curriculum emphasizes the necessity of understanding customer or stakeholder needs and in articulating a cogent value proposition in order to implement or scale an idea, technology, product, or program. “The founding concepts for the I-Corps program were informed by the extensive experience in supporting the Small Business Innovation Research (SBIR) program at NSF and the challenges we know that exist in transitioning a technology from the lab to the market,” shared Errol Arkilic, founding and former lead program director for I-Corps. [Arkilic, E., personal communication with the Policy Design Lab, January 5, 2017.]

By pairing participants with business mentors and using an intensive curriculum to help them discover a “demand-driven path” from their laboratory research to a marketable product. Rather than pushing out innovations they believe to have strong commercialization potential, participants first validate their hypotheses by sourcing feedback. By gathering strong evidence that validates their business model, participants can increase the likelihood they will build something someone cares about. “Overall, the experience relies on evidence-based decision-making. And it’s evidence that you can’t gather in a lab; you have to go to the people that are the important stakeholders in the ecosystem,” explains Lydia McClure, Program Director for I-Corps at NSF. [McClure, L., phone interview with the Policy Design Lab, July 19, 2016.]

As part of the I-Corps curriculum, researchers learn key business principles, such as:

* Commercializing a new invention requires the identification of a viable business model, not just an increase in the technological maturity of an invention
* Discovering the elements of a successful business model (e.g. value proposition, customer segments, sources of revenue) requires gathering evidence to test and refine their initial hypotheses by talking to many different potential customers and partners—leaving the lab and “getting out of the building”
* Planning and defining a prototype based on early feedback from potential customers, which reduces the time and cost associated with the commercialization process

[Sourced directly from Kalil, T., and Rockey, S. [“From Lab to Bench to Bedside: Accelerating Commercialization of Biomedical Innovations”,](https://www.whitehouse.gov/blog/2014/06/19/lab-bench-bedside-accelerating-commercialization-biomedical-innovations)  National Institutes of Health, June 19, 2014.]

See additional Toolkit content on additional applications of Lean Startup methodologies to Federal work. [[Crosslink to Lean Startup content]]

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| **Distinctions between Lean Startup, Lean LaunchPad, Hacking for Defense/Diplomacy, and I-Corps.**  I-Corps is based on the Lean LaunchPad (LLP) curriculum developed by Steve Blank and focuses on the commercialization of research. While several Federal agencies have applied I-Corps programming, others have used variants of Lean LaunchPad programming. Agency LLP programs are still considered part of the I-Corps network because of their use of the NSF’s National Innovation Network (NIN) to implement LLP in their programs. Agencies with LLP programming also still execute MOUs with NSF to access the NSF’s NIN and other resources. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.]  I-Corps has been the most structured and visible application of Lean Startup thinking into the public sector. While Lean Startup is a broader entrepreneurial methodology, the I-Corps program is one structured approach to teach the methodology and to accelerate commercialization/solution-finding. While the same foundational principles hold, one key difference is that the I-Corps formulation starts with a technology that’s seeking a market, rather than starting with a customer problem/need and iterating on a solution. [Holman, R., phone interview with Policy Design Lab, August 12, 2016.]  Hacking for Defense is another iteration of Lean Startup-related programming. In the Hacking for Defense/Diplomacy classes, Federal agencies provide universities with problems and teams of students use the same Lean LaunchPad/I-Corps method to provide solutions.) [Blank, S., personal communication with Policy Design Lab, January 5, 2017.] |

This promising approach can be deployed further to assist Departments and agencies in commercializing research as well as developing technology and tools for internal use. I-Corps programs have been adopted and adapted in partnerships with a [growing number of Federal agencies](https://www.whitehouse.gov/the-press-office/2015/08/04/fact-sheet-president-obama-announces-new-commitments-investors-companies), including the [National Institutes of Health (NIH)](https://sbir.cancer.gov/programseducation/icorps), [Department of Energy (DOE)](http://energy.gov/eere/technology-to-market/lab-corps), [Department of Defense (DOD](http://www.defense.gov/)), [National Security Agency (NSA)](https://www.nsa.gov/), [United States Department of Agriculture (USDA)](http://www.usda.gov/wps/portal/usda/usdahome), [Department of Homeland Security (DHS),](https://www.dhs.gov/) [Advanced Research Projects Agency – Energy (ARPA-E)](https://arpa-e.energy.gov/), [National Aeronautics and Space Administration (NASA)](http://sbir.gsfc.nasa.gov/content/I-Corps), and the [Small Business Administration (SBA).](https://www.sba.gov/)

To date, agency program variations have chosen to address:

* Extramural university researchers (i.e., researchers receiving Federal funding)
* Intramural researchers (e.g., research scientists at agency labs)
* Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) funded companies.
* on-academic technologists (i.e., alumni or community-based entrepreneurs)

**Why**

The chief purpose of the I-Corps program is to increase entrepreneurship and the commercialization of technology that has been developed with the support of NSF-funded research.[]This is essential for increasing the economic impact of Federally-funded research and development by accelerating and improving the transfer of new technologies from the laboratory to the commercial marketplace. The Federal government invests over $ [145](https://www.whitehouse.gov/sites/default/files/omb/budget/fy2017/assets/ap_19_research.pdf) billion on research and development each year, conducted at universities, Federal laboratories, and companies; this work has yielded extraordinary long-term economic impact through the creation of new knowledge and ultimately new industries [Wynne, M., personal communication with Policy Design Lab, December 16, 2016.] Federally-funded R&D has historically led to dramatic economic growth, and there is significant potential to increase the public’s return on this investment in terms of innovation, job creation, societal impact, competitiveness, and economic prosperity [Kalil, T. and Wong, J.,“[Lab-To-Market](https://www.performance.gov/content/lab-market?view=public)”. Performance.gov]. I-Corps was designed to encourage agencies to see commercialization as an appropriate activity to support, according to Errol Arkilic, former program director for NSF I-Corps. [Arkilic, E., phone interview with Policy Design Lab, December 30, 2016.]

I-Corps is part of the *Lab to Market* Cross Agency Priority Goal, which seeks to “significantly accelerate and improve technology transfer by streamlining administrative processes, facilitating partnerships with industry, evaluating impact, and opening federal research and development (R&D) assets as a platform for innovation and economic growth.” [Kalil, T. and Wong, J., *[Lab to Market: Cross Agency Priority Goal Quarterly Progress Update, Fiscal Year 2015 Quarter 4,](https://s3.amazonaws.com/app_performance_prod_ahwdtloxcxcy/s3fs-public/Lab%20to%20Market%20FY15_Q4_1.pdf)* [Performance.gov.]](https://s3.amazonaws.com/app_performance_prod_ahwdtloxcxcy/s3fs-public/Lab%20to%20Market%20FY15_Q4_1.pdf)

**How**

I-Corps has been an avenue for foster researching commercialization or lab-to-market initiatives. I-Corp programs facilitate evidence gathering and provides a framework for quickly responding to that evidence. While the program is highly structured, it has also been adapted to fit the specific needs at each of the agencies that have deployed I-Corps programming. The NSF has helped facilitate the launch of new I-Corps or Lean LaunchPad programs at agencies using a technique called train-the-trainer, where individuals work with the NSF-funded [National Innovation Network](https://venturewell.org/i-corps/nin/) (NIN) to adopt the I-Corps program for their constituents while ensuring the scale-up and maintenance of quality programming.

NSF is open to working with other interested agencies to develop I-Corps or Lean LaunchPad variants through a memorandum of understanding process.

How the I-Corps model works:

I-Corps Team Structure [McClure, L., personal communication with the Policy Design Lab, January 4, 2017]

The I-Corps team is typically composed of three individuals with distinct roles:

1. Entrepreneurial Lead (EL)
2. I-Corps Mentor
3. Principal Investigator (PI) / Technical Lead (TL)

The Entrepreneurial Lead (EL) could be a Post -Doctoral scholar, graduate or other student or other personnel with relevant knowledge of the technology and a deep commitment to investigate the commercial landscape surrounding the innovation. The Entrepreneurial Lead should also be capable of and have the will to support the transition of the technology, should the I-Corps project demonstrate the potential for commercial viability.

The I-Corps Mentor is typically an experienced or emerging entrepreneur with proximity to the research institution and experience in transitioning technology out of labs. The I-Corps Mentor must be a third-party resource. The I-Corps Mentor is responsible for guiding the team forward and tracking progress through regular communication with the instructors.

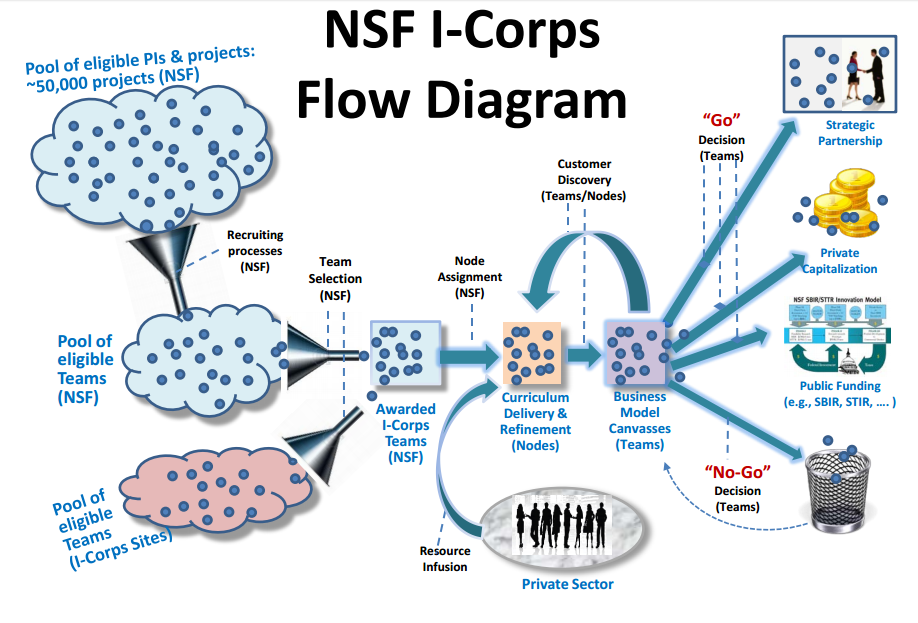
The Principal Investigator (PI) / Technical Lead (TL) is responsible for overall grant management and should have technical knowledge in the space.

Curriculum

The I-Corps curriculum is based on the Lean LaunchPad framework developed by Steve Blank. The program emphasizes experiential learning and Lean Startup thinking rather than learning by lecture. The canonical I-Corps model is a rigorous seven-week course, in which participants work with trainers and mentors to test how research and technologies could be commercialized by seeking input from potential customers or stakeholders. Each week, a discrete set of business hypotheses are tested by the researchers by collecting interview data from the proposed target market [“[I-Corps Curriculum](https://www.nsf.gov/news/special_reports/i-corps/curriculum.jsp)”, National Science Foundation]. Business models are developed and iteratively refined from this discovery process. By the end of the course, teams have performed at least 100 interviews with stakeholders or potential customers in their ecosystem. The results of this effort are then evaluated by the team who collectively decide whether they continue to develop and commercialize their technology, pivot and explore other market segmentation or customer fits, or suspend their commercialization effort. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.]

Instruction is provided via online platforms and through on-site activities at one of eight regional [I-Corps Nodes](http://www.nsf.gov/news/special_reports/i-corps/nodes.jsp), including:

* Southwest I-Corps
* Los Angeles I-Corps
* Upstate New York I-Corps
* [Bay Area I-Corps](http://bayicorps.com/)
* [Southern I-Corps](http://innovate.gatech.edu/programs/innovation-corps-icorps/)
* [Midwest I-Corps](http://www.michiganicorps.com/)
* [New York City Regional Innovation Node](http://www.nycrin.org/nycrin/i-corps.html)
* [DMV I-Corps](http://www.dcicorps.org/) [[Also embed pop-up spotlight content – see below]]



[Arkilic, E., “[Lean Startup: Lessons from the field of 300 Innovation-Corps (Lean LaunchPad) Teams](http://web.stanford.edu/group/ifarmteams/files/ErrolArkilicSlides.pdf)”, National Science Foundation]

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| **I-Corps Regional Nodes:** [**Spotlight on UMD**](http://innovation.umd.edu/learn/i-corps/) **/ DMV Node:**  UMD is one of the universities selected as a [lead university in NSF’s I-Corps Node program](http://www.mtech.umd.edu/news/press_releases/nsf_icorps.html). Together, these eight I-Corps nodes form the backbone of the NSF’s National Innovation Network, which links together over 70 universities with established entrepreneurs and venture capitalists to train faculty and student researchers from throughout the U.S. to transform ideas into products and get them on the market. The intensive and highly experiential I-Corps program was developed by entrepreneurs and is taught by entrepreneurs (including Steve Blank, creator of the I-Corps curriculum and adjunct professor at Stanford) and was featured in this [Harvard Business Review cover story](http://steveblank.com/2013/04/16/when-hell-froze-over-in-the-harvard-business-review/). It emphasizes conducting hundreds of experiments, or interviews, with as many potential customers as possible; gaining insights about the significant pain points and needs of specific customers; and tracking the results of those experiments on a business model canvas.  UMD offers several variants of the I-Corps program:   * An Intro to I-Corps program for UMD faculty interested in commercializing their research * A FedTech I-Corps course providing UMD students with opportunities to work with NASA, NIH, DOE, DOD, and other federal agencies to commercialize technologies * An Innovation Boot Camp workshop and program for clients like the [U.S. Department of Health and Human Services IDEA Lab](http://www.hhs.gov/idealab/ignite-syllabus/the-boot-camp/) and the U.S. Department of Justice Concept Lab that combines Lean Startup with Design Thinking to help teams from those organizations advance their innovation projects.   Read more from Steve Blank: “[The Big Bang: The Lean LaunchPad Explodes at University of Maryland](https://steveblank.com/2014/12/10/the-big-bang-the-lean-launchpad-explodes-at-university-of-maryland/).”    Source: [“[About](http://innovation.umd.edu/learn/i-corps/)”, Academy for Innovation and Entrepreneurship] |

### **Deliverable 2: Summary of underlying rationales / empirical research**

The reality underlying the I-Corps approach is that once an idea is exposed to and tested in the real world, the understanding about what is viable often changes. When researchers go into the field through their I-Corps training, they aren’t promoting their technology – they are listening to and learning about their potential customers’ needs and problems. Participants evaluate whether their research or technology will address those needs or whether their plan requires a course alteration to align their ideas with those of their stakeholders or customers.

“A lot of people think entrepreneurialism is an execution process, but it’s not. It’s a search process – a search for a business model. No one understands this stuff going in. Why would they? But we’ve cracked the code on how to teach entrepreneurialism to scientists and engineers without wasting their time.” [Steve Blank](http://www.forbes.com/sites/nicolefisher/2014/12/12/steve-blank-challenges-federal-government-to-lean-entrepreneurship/#4b9e6c6d6edf), serial entrepreneur and creator of the Lean LaunchPad course that later formed the basis for NSF’s I-Corps curriculum. [Grose, T. K.,“[To Market, to Market](http://www.asee-prism.org/to-market-to-market-dec/)”, ASEE Prism, December 2014]

**Benefits of I-Corps**

Researchers who have participated in the I-Corps program have a much higher success rate of attracting early-stage technology funding, and report that the experience has materially shaped how they choose future research topics with greater economic and societal relevance. As of December 2016, over 950 teams had completed the NSF’s I-Corps boot camp, leading to the creation of more than 320 companies that collectively have raised more than $95 million in seed funding. Additionally, 4 of the founded companies have already been acquired. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.] An NSF survey of their initial 2011 I-Corps cohort found that the changes in knowledge levels before-and-after the boot camp were “dramatic,” reports Steve Blank, leading NSF to continue to invest in scaling the program [Blank, S., “[Making a Dent in the Universe – Results from the NSF I-Corps](https://steveblank.com/2012/06/11/making-a-dent-in-the-universe-results-from-the-nsf-i-corps/)”, June 11, 2012].

Researchers also attest to the impact of I-Corps programs. According to Ralph Muehleisen, a researcher from Argonne National Laboratory and a recent graduate of the Department of Energy’s [Lab-Corps](http://energy.gov/eere/technology-to-market/lab-corps), DOE’s I-Corps program, the experience was deeply valuable: “I strongly recommend Lab-Corps to any researchers trying to develop technologies that need to be adopted by industry or consumers. The program taught me so much about the needs of industry and how those needs can be met by researchers. Sometimes, it’s easy for us to get caught up in the research and not think about how the commercial impact of our science and technology can actually impact lives. Lab-Corps showed me how I can maximize the benefit of my basic research at Argonne to create technology that has real-world commercial impacts for Americans ” [Kalil, T., “[Progress on President Obama’s “Lab to Market” Initiative](https://www.whitehouse.gov/blog/2016/07/12/progress-president-obamas-lab-market-initiative)”, The White House, July 12, 2016].

**Watch:** Why does the I-Corps model work so well? Student insights from Lean LaunchPad / NSF I-Corps:

* [Getting to the “Better Idea” faster](https://vimeo.com/groups/213077/videos/81146693)  [4:00 min]
* [Why Researchers Need to Get Out of the Building](https://vimeo.com/groups/213077/videos/79755368) [1:40 min]
* [“You Stop Telling Yourself What You Want to Believe”](https://vimeo.com/groups/213077/videos/79544174) [2:15 min]

#### **Deliverable 3: Profiles of major categories of candidate users - examples of when to deploy**

**When, how to use:**

I-Corps can have multiple applications. Recognizing that there are different customer segments within government, the I-Corps curriculum has been customized, modified and enhanced across the Federal space to accelerate commercialization, improve value, and maximize the return on their R&D investment.. Some agencies use I-Corps for agency-funded academic researchers to support commercialization; others fund agency researchers to support commercialization, some use it for SBIR companies so that startups are more likely to succeed, while other agencies use variants of I-Corps for their own staff to fuel agency-adopted innovation. [Erickson, J., personal communication to Policy Design Lab, December 18, 2016].

A summary of agency programming, as of January 2017:

[McClure, L., personal communication with the Policy Design Lab, December 27. 2016.]

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| --- | --- | --- |
| **Agency** | **I-Corps or LLP** | **Program Name** |
| NSF | I-Corps | I-Corps Teams |
| NSF | LLP | Beat-the-Odds Bootcamp |
| NSF | I-Corps | I-Corps for Learning |
| NSF | I-Corps | Phase I with NIH |
| DOE EERE | I-Corps | Energy I-Corps (or Lab Corps) |
| NSA | LLP | I-Corps@NSA |
| NIH/CDC SBIR | I-Corps | [I-Corps@NIH](mailto:I-Corps@NIH) |
| DOE ARPA-E | I-Corps | I-Corps@ARPA-E |
| DHS SBIR | I-Corps | I-Corps@DHS S&T |
| NASA SBIR | I-Corps | [I-Corps@NASA](mailto:I-Corps@NASA) |
| DOD ARL | I-Corps | [I-Corps@DOD](mailto:I-Corps@DOD) |
| USDA NIFA | I-Corps | NIFA I-FAST prize competition |
| SBA | LLP | Lean for Main Street Training Challenge |
|  |  |  |
| **Agency LLP programs hosted by NIN:** |  |  |
| **Agency** | **Node** | **Program Name** |
| NIH NCATS SBIR | Midwest | I-Corps@NCATS |
| USDA ARS | Midwest | I-Corps@ARS |
| NSF SBE | Texas | I-Corps for Policy |
| DoD | Bay Area | Hacking for Defense |
| State Department | Bay Area | Hacking for Diplomacy |
| State Department | VentureWell | GIST Bootcamps |
| DoD AFRL | LA | Unknown |
| HHS CDC | South | CDC I-Catalyst |
| DOE ARPA-E | Midwest | I-Corps for Energy and Transportation |
| HHS IDEA LAB | DMV | HHS Ignite Accelerator |
| Federal Labs | DMV | FedTech |
| NIH NCI | DMV | NIH NCI SPRINT |
| Crane Naval Surface Warfare Center | Midwest | Unknown |
| Air Force Research Lab | Midwest | Unknown |

**R&D, both basic and applied:**

I-Corps was developed particularly to address the translation of R&D efforts to commercial technologies, but the value of the methodology could be more broadly applied even beyond the I-Corps lens. For instance, agencies could require that applied R&D have a clear, early “customer discovery” phase with a “go, no-go” decision point dependent on its results. If a viable market is found, the sponsoring agency would then re-evaluate the pursuit of that line of R&D. The approach would require additional agency funding at the outset, but in the long-run could drive significant cost savings by identifying and promoting the research activities most likely to impact the market [Kalil, T., “[Progress on President Obama’s “Lab to Market” Initiative](https://www.whitehouse.gov/blog/2016/07/12/progress-president-obamas-lab-market-initiative)”, The White House, July 12, 2016]

**Internal process innovation**

A number of Federal agencies have experimented with derivations of I-Corps that are broader in scope, but still maintain the core principles of Lean LaunchPad. Rather than focusing on scientists within labs, these “internal innovation accelerators” provide a flexible model for developing new ideas to meet agency goals. These programs follow the basic elements of startup accelerators that are common in the private sector. The core elements include: competitive entry, seed-funding and resources, coaching/ instruction, and a defined time-frame to explore and test out the idea. Most accelerator programs also end with a “Demo Day” where the small startup team pitches their idea to potential investors to take it to the level. [Holman, R., personal communication with Policy Design Lab, December 18, 2016]  
  
“The accelerator models provide the space to test out and explore solutions,” notes Read Holman, formerly with the Office of Science and Technology Policy, while empowering employees “to address the topics they're most interested in.” [Holman, R., phone interview with Policy Design Lab, August 12, 2016.] These programs are based on the observation that the best ideas can come from any part of an organization and that the existing bureaucratic structure isn’t sufficient supportive of the testing of these ideas to see if they are worth carrying further. While focused on supporting internal staff, they may also involve external partners.  
  
While I-Corps has a fairly specific definition and fits only into certain federal organizations, internal accelerators can be tools for mid- to senior-level management staff in any organization. For instance, with [HHS Ignite,](http://www.hhs.gov/idealab/what-we-do/hhs-ignite/) the Department of Health and Human Services found that the flexibility of the accelerator model allowed them to emphasize their toughest challenges while bringing in elements of Lean Startup and other innovative approaches like design thinking to provide the most effective solutions. [Holman, R., phone interview with Policy Design Lab, August 12, 2016.] [LINK to HCD and HHS deep dive]

#### **Deliverable 4: One or more “success stories” or learning narratives to underscore impact**

**Case studies:**

**1. National Science Foundation**

**2. National Institutes of Health**

**3. Department of Energy’s Lab-Corps**

**Case focuses:**

**Case 1:** [**National Science Foundation - I-Corps**](http://www.nsf.gov/news/special_reports/i-corps/teams.jsp)

[[High-res JPG available here]](http://www.nsf.gov/news/mmg/media/images/icorps_logo_h2.jpg)

**Summary:** The canonical NSF I-Corps program provides immersive education to academic engineers and scientists to help them explore the commercial viability of their technologies and form successful small business. By preparing researchers to look beyond the laboratory, it broadens the impact of NSF-funded, basic-research projects and helps to create a stronger national ecosystem for innovation.

**Key accomplishments (Impact):** The NSF I-Corps program was started in 2011 to increase the economic impact (through commercialization) of NSF-funded basic research, according to founding program director Errol Arkilic. [Arkilic, E., phone interview with Policy Design Lab, December 30, 2016.] Since then, NSF has increased the annual I-Corps program budget from $2M in FY2011 to $30 million in FY2017, held 44 cohorts, worked with 950 teams of 2900 individuals through the national I-Corps program, and created a National Innovation Network of over 70 universities that has taught a version of the I-Corps curriculum to tens of thousands of researchers. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.]As the NIN expands, the applicability of the I-Corps curriculum has found utility outside of academic institutions; NIN works with both academic and non-academic researchers and entrepreneurs. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.]

The impact of I-Corps is measured at the level of the institution, individual, and company, explains Lydia McClure. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.] I-Corps expects NIN to impact culture change at the academic institutions by encouraging entrepreneurial curricula to be incorporated in the classroom, entrepreneurship activity to be recognized and supported by the institution and individual research labs, and intellectual property licensed to new startups. The accelerator model of I-Corps allows individual assessment of participants in their entrepreneurial self-efficacy and career trajectory. Lastly, startup success metrics can be measured as the research is transferred to industry in license revenue, jobs created, sales revenue, private funding raised, etc.

**How they did it:**

As the founding agency for the SBIR program and with deep relationships in supporting basic research, NSF had extensive experience in the challenges of transition research to commercial applications. They relied on this experience and sought guidance from established entrepreneurs to develop a targeted curriculum where I-Corps participants could learn to identify valuable product opportunities that can emerge from NSF-supported academic research.

NSF relied on a quick-turn, internal-review for proposals and limited their size to $50,000. The founding principle was to quickly provide small catalytic funds on a quarterly cycle; the near continuous cycle allowed teams to explore the commercial potential on concepts as they emerged from the lab. [Arkilic, E., personal communication with the Policy Design Lab, January 5, 2017.] Innovation opportunities do not conveniently present themselves on yearly grant cycles, Founding program director Errol Arkilic remarked. [Arkilic, E., personal communication with the Policy Design Lab, January 5, 2017.]

**How it works:**

With guidance from established entrepreneurs and through a targeted curriculum, I-Corps participants learn to identify valuable product opportunities that can emerge from NSF-supported academic research. Over a period of six months, each team learns what it will take to achieve an economic impact with their particular innovation.

**Read more:**

[From Science Lab to Startup](https://www.whitehouse.gov/blog/2012/08/10/nsf-innovation-corps-science-lab-startup)

[FY17 NSF budget (provides program scope)](https://www.nsf.gov/about/budget/fy2017/pdf/38_fy2017.pdf)

**Case 2:** [**National Institutes of Health – I-Corps**](http://sbir.cancer.gov/resource/icorps/)

[Portilla, L., Canaria, C. and Weingarten, M., personal communication with Policy Design Lab, January 11, 2017; “[I-Corps at NIH](https://sbir.cancer.gov/programseducation/icorps),” National institutes of Health.]

**Summary:**

Begun in 2014, NIH’s I-Corps program is a variant of the NSF program specially tailored to life sciences and biomedical research. NIH-funded researchers receive real-world, hands-on entrepreneurship training from life science domain experts and National Innovation Network trained instructors. Together, they evaluate the potential of Federally-funded scientific discoveries for commercial application. The NIH I-Corps program goal is to accelerate the translation of biomedical innovations into applied health technologies. The program is open to academic researchers and entrepreneurs with [Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)](http://www.sbir.gov/) phase one awards (which establish feasibility of commercializable technology) from participating NIH and CDC institutes. [[I-Corps at NIH](https://sbir.cancer.gov/programseducation/icorps),” National institutes of Health.]

In 2016, the [National Center for Advancing Translational Sciences (NCATS)](https://ncats.nih.gov/) of the NIH began applying the I-Corpsteaching methodology under a pilot initiative to its [Clinical and Translational Science Awards (CTSA) program](https://ctsacentral.org/). By training a new cadre of I-Corps educators and researchers at 9 CTSA-funded academic medical institutions, they in turn will provide entrepreneurship training for other translational scientists. The CTSA I-Corps program strives to prepare participants within the CTSA program to identify and develop valuable commercial opportunities that emerge from the research setting, with the intent of translating discoveries more quickly into treatments and cures for patients [“[White House Announces NIH Expansion of Innovation Corps Training Opportunities](https://ncats.nih.gov/newsletters/vol04-iss08/aug2015.html#icorps)”, National Center for Advancing Translational Sciences, August 2015.]

**Key accomplishments (Impact):** In FY2016, the NIH supported I-Corps training for 114 researchers and entrepreneurs. The NIH I-Corps program helps to “leverage NIH's robust SBIR/STTR program and further NIH's mission to advance our understanding of human illness and treatment of disease and disability," said NIH SBIR/STTR program coordinator Matthew Portnoy. [“[NIH and NSF collaborate to accelerate biomedical research innovations into the marketplace](https://www.nih.gov/news-events/news-releases/nih-nsf-collaborate-accelerate-biomedical-research-innovations-into-marketplace)”, National Institutes of Health, June 18, 2014.] In 2017, the program expands to two cohorts of SBIR/STTR grantees, including life-sciences entrepreneur project teams, across 17 Institutes and Centers at the NIH and the Centers for Disease Control “[NIH and NSF collaborate to accelerate biomedical research innovations into the marketplace](https://www.nih.gov/news-events/news-releases/nih-nsf-collaborate-accelerate-biomedical-research-innovations-into-marketplace)”, National Institutes of Health, June 18, 2014.]

I-Corps at NIH case studies of several participating companies:

* Following customer discovery activities in I-Corps at NIH, GigaGen, Inc. established a collaboration with Cellular Therapeutics LTD (CTL) in England. This enables application of GigaGen’s platform technology to analyze patients’ cancer cells (supplied by CTL) for the discovery of novel cancer immunotherapies. [Portilla, L., personal communication with Policy Design Lab, January 11, 2017.]
* Novoron learned through customer discovery that they had opportunities to pivot their customer segments. Their proprietary therapeutic was initially targeted to spinal-cord injury patients, but they learned through I-Corps at NIH that applications for multiple sclerosis (MS) were highly relevant. They subsequently secured a new NIH Phase I SBIR grant to study MS.  [Portilla, L., personal communication with Policy Design Lab, January 11, 2017.]

**How it works:** I-Corps at NIH is an 8-week entrepreneurship training bootcamp programmatically managed by staff at the National Cancer Institute on behalf of the NIH and CDC. Three notable differences to the NIH program include 1) established companies (SBIR/STTR awardees) go through the program rather than academic teams; 2) a modification to the 3 team member structure and 3) the pairing of life science technical domain experts with NIN-trained instructors. [Canaria, C., personal communication with Policy Design Lab, January 11, 2017.]

In contrast to the NSF model, the NIH 3-member teams are comprised of a C-level corporate officer; a Program Director/Principle Investigator (PD/PI); and an Industry Expert. It is strongly recommended that the participating C-Level Corporate Officer be the CEO of the applicant team; however, other C-Level corporate officers may also serve in this role. In this context, C-Level refers to "Chief" Technology Officer, "Chief" Operating Officer, or similar level officer. This person should have relevant knowledge of the technology and a deep commitment to investigate the commercial landscape associated with the innovation. This person should have substantial decision-making authority within the company to implement changes in direction regarding the overall commercialization strategy for the project/technology. It is anticipated that the knowledge gained during the I-Corps™ training could have a significant impact on the corporate commercialization strategy; therefore, it is recommended that the C-Level Corporate Officer should lead the three-member I-Corps™ team. The PD/PI has primary responsibility for achieving the technical success of the project, while also complying with the financial and administrative policies and regulations associated with the SBIR/STTR award. In the scenario where the PD/PI is also the CEO of the small business, applicants are encouraged to consider designating an alternate C-Level Corporate Officer to lead the team. The designated Industry Expert should be an experienced or emerging entrepreneur with proximity to the SBC and experience in translating technologies to the marketplace. The Industry Expert may be someone that has an established relationship with the company (e.g., Board Member), or this person may be selected as a third-party resource. Ideally, the Industry Expert should have prior experience in the development and commercialization of other products within the broader technology space related to the specific SBIR/STTR project under development. [Canaria, C., personal communication with Policy Design Lab, January 11, 2017.]

Similar to canonical NSF I-Corps, the NIH program progresses with a 3.5 day in-person kickoff, 6 virtual Webex classes, and a 2 day in-person closing. Cohort size is capped at 24 companies and teams are roughly distributed across three domain tracks: therapeutics; medical devices; and diagnostic/research tools/digital health. Each track is taught by a pair of instructors: one technical domain expert with entrepreneurial expertise and one NIN-trained I-Corps instructor. The domain experts are embedded with the tracks over the 8 weeks and the I-Corps instructors rotate through the tracks every 2-3 weeks. [Canaria, C., personal communication with Policy Design Lab, January 11, 2017.]

**Read more:**

[I-Corps at NIH](https://sbir.cancer.gov/programseducation/icorps)

[From Lab to Bench to Bedside: Accelerating Commercialization of Biomedical Innovations](https://www.whitehouse.gov/blog/2014/06/19/lab-bench-bedside-accelerating-commercialization-biomedical-innovations)

[Why Lean May Save Your Life: The I-Corps at NIH](http://www.xconomy.com/san-francisco/2014/06/19/why-lean-may-save-your-life-the-i-corps-at-nih/)

**Case 3: Department of Energy’s Lab-Corps**

**Summary:** The Energy Department’s $2.3 million [**Lab-Corps Initiative**](http://energy.gov/sites/prod/files/2015/08/f25/64779.pdf) officially commenced in October 2015, following a successful [pilot](http://energy.gov/sites/prod/files/2015/03/f20/DOE%20Lab-Corps%20Pilot%20Summary_EERE%20Comms_3-6-15.pptx) kick-off in 2014. DOE’s Lab-Corps program is a specialized training curriculum aimed at accelerating the transfer of clean energy technologies, such as sustainable transportation, renewable power, and energy efficiency technologies, from national laboratories into the commercial marketplace. As part of the Lab-Corps program, national laboratories assemble, train, and support entrepreneurial [Lab-Corps teams](http://energy.gov/eere/technology-to-market/lab-corps-teams) to identify private sector opportunities for commercializing promising technologies. (Eight DOE laboratories have been selected to participate in the program.) Lab-Corps also functions as an innovative program space for participating national laboratories to test innovative models, with the goal of also identifying best practices that would support potential full-scale implementation of the Lab-Corps program across the entire DOE national laboratory space. [“[Lab-Corps](https://energy.gov/eere/technology-to-market/lab-corps)”, U.S. Department of Energy.]

**Key accomplishments (Impact):** Lab-Corps has already provided training to more than 50 teams in four cohorts. Teams from the first and second cohorts have already secured nearly $7 million in follow-on funding. [“[Lab-Corps](https://energy.gov/eere/technology-to-market/lab-corps)”, U.S. Department of Energy.] "What gets me incredibly excited about Lab-Corps is that we're taking this tremendous asset -- world-class set of national labs that we have in this country -- and we're taking their commercial engagement and commercial impact to a completely different level," said David Danielson, former Assistant Secretary for the Office of Energy Efficiency and Renewable Energy, DOE. [“Energy Department's Lab-Corps Program Trains Scientists in Commercialization”, U.S. Department of Energy, May 11, 2016]

**How they did it:** Lab-Corps teams participate in a seven-week entrepreneurial boot camp facilitated by the U.S. Department of Energy's (DOE's) [National Renewable Energy Laboratory](http://www.nrel.gov/). Each cohort includes in-person sessions and weekly webinars to help teams learn how to evaluate the market potential of their technologies and bring a new level of entrepreneurial education back to their research and colleagues. This training includes access to a suite of commercialization resources and tools that help teams, for example, develop mechanisms to obtain direct market feedback on technologies, establish startup companies, partner with industry partnerships, and draft licensing agreements, among other elements.

**Watch:** [Lab-Corps program trains scientists in commercialization](https://www.youtube.com/watch?v=w4O8O-pgu5s)[3 min]

**Watch:** [National Lab Scientists Praise Entrepreneurial 'Boot Camp' [1.5 min]](http://energy.gov/eere/articles/national-lab-scientists-praise-entrepreneurial-boot-camp)

**Read more:**

[Lab-Corps factsheet](http://energy.gov/sites/prod/files/2015/09/f26/64779.pdf)

[A DOE Lab-Corps participant explains his journey from invention to market](https://www.whitehouse.gov/blog/2014/10/29/empowering-entrepreneurial-labs-new-lab-corps-program-accelerates-energy-technologie)

**For more information:** Contact lab-corps@nrel.gov

**Case focuses:**

**Case Focus 1**. [**Department of Energy’s** Advanced Research Projects Agency–Energy (ARPA-E **(ARPA-E) – I-Corps**](http://arpa-e.energy.gov/?q=site-page/i-corps-arpa-e) @ ARPA-E

**Summary:** In early 2013, [ARPA-E](http://arpa-e.energy.gov/?q=site-page/i-corps-arpa-e) partnered with the National Science Foundation (NSF) to pilot “I-Corps @ ARPA-E”. Preparing technologies for an eventual transfer from lab to market is a key element of ARPA-E's mission, specifically enumerated in its statutory Congressional mandate. I-Corps is now a key component of ARPA-E’s technology transfer strategy.

**Read more:** “[Behind the scenes with Nate Gorence, ARPA-E Tech-To-Market Advisor](https://arpa-e.energy.gov/?q=news-item/behind-scenes-nate-gorence-arpa-e-tech-market-advisor),” November 2016

# **Watch:**

# [ARPA-E University: NSF I Corps and the Value of Customer Discovery in Research and Development](https://www.youtube.com/watch?v=i_rc1RiSGL8) [60 min]

[Why Startups?](https://www.youtube.com/watch?v=RB_qBtICzzE) [DOE video - 4 min]

# [The Scientific Method for Getting Technology to Market](https://www.youtube.com/watch?v=boI04_TS--o) [50:49; Steve Blank speech at 2012 ARPA-E Energy Innovation Summit]

**For more information:** Contact ARPA-E’s Technology-to-Market Team at [ARPA-E-T2M@hq.doe.gov](mailto:ARPA-E-T2M@hq.doe.gov)

**Case Focus 2. The United States Department of Agriculture (USDA) Agricultural Research Service (ARS) – I-Corps@ARS**

[Bahar, M., personal communication with Policy Design Lab, January 11, 2017].

**Summary**: In 2015, the United States Department of Agriculture (USDA) Agricultural Research Service (ARS) collaborated with NSF to launch an I-Corps@ARS pilot. The pilot objective was to prepare ARS scientists to extend their focus beyond the laboratory and broadened the impact of select ARS research projects. Each team was composed of one ARS scientist, one post-doctoral fellow and one technology transfer professional. I-Corps@ARS program staff report that it was the first I-Corps variant with an intramural focus, and was designed to serve as a model for researchers in government-owned and –operated laboratories across Federal agencies. [Bahar, M., “[I-Corps ARS- A New Twist on NSF’s I-Corps Model](http://slideplayer.com/slide/9041384/)”, U.S. Department of Agriculture.]

**How they did it**: For ARS, the benefit of I-Corps@ARS was creating an entrepreneurial culture within the agency by engaging scientists in the business side of science. The paradigm offered by the I-Corps curriculum enabled scientists to do more impactful research, with one participant noting: “Instead of finishing a project and trying to fit a square peg to a circular hole, the research project can be guided in the right direction from interviews with customers and stakeholders. Therefore, the end product is such that it fits the expressed needs of the customers and has immediate added value.” [Bahar, M., “[I-Corps ARS- A New Twist on NSF’s I-Corps Model](http://slideplayer.com/slide/9041384/)”, U.S. Department of Agriculture.]

**Learn more:** [I-Corps@ARS: A new twist on NSF's I-Corps model](http://slideplayer.com/slide/9041384/)

**Case Focus 3: Department of Defense (DOD) – I-Corps@DOD**

[Holland, T. J., personal communication with Policy Design Lab, January 11, 2017.]

**Summary:** In 2016, the DOD launched a new commercialization pilot program with NSF for DOD-funded academic researchers. Modeled after the National Science Foundation (NSF) I-Corps program, the Innovation Corps at the Department of Defense (I Corps @ DoD) program aims to build on the success realized by NSF and deliver the best capability to the warfighters of the future. "I think at the highest level, everybody understands our country is facing continuous disruption by adversaries who are using asymmetric warfare to negate 75 years of U.S. military dominance…our adversaries are moving both asymmetrically and with speed, therefore our own encounter is to innovate at faster speeds," said Steve Blank, the original creator behind the I-Corps curriculum. [Corrin, A., “[Can DoD regain the technological edge?](http://www.c4isrnet.com/story/military-tech/it/2015/12/08/can-dod-regain-the-technological-edge/76994196/)”, C4isrnet, December 8, 2015.]

**Summary:** The Department of Defense (DOD) will launch a new commercialization pilot program with NSF later this year for DOD-funded academic researchers. Modeled after the National Science Foundation (NSF) I-Corps program, the Innovation Corps at the Department of Defense (I Corps @ DoD) program aims to build on the success realized by NSF and deliver the best capability to the warfighters of the future. "I think at the highest level, everybody understands our country is facing continuous disruption by adversaries who are using asymmetric warfare to negate 75 years of U.S. military dominance…our adversaries are moving both asymmetrically and with speed, therefore our own encounter is to innovate at faster speeds," said Steve Blank.

**Key accomplishments (Impact):** I Corps @ DOD is an opportunity for principal investigators (PIs) to learn how to commercialize their discoveries and innovations. Winning proposals receive a $40,000-$70,000 grant as well as extensive training in product commercialization from industry experts and serial entrepreneurs. [“[Proof of Concept Commercialization Pilot Program -- Innovation Corps @ Department of Defense (I Corps @ DoD)](https://researchfunding.duke.edu/proof-concept-commercialization-pilot-program-innovation-corps-department-defense-i-corps-dod)”, Duke University]

**How they did it:** The goals of this program are to spur the transition of fundamental research, to encourage collaboration between academia and industry, and to train students to understand innovation and entrepreneurship. The purpose of the I Corps @ DOD program is to identify DoD-funded researchers who will receive additional support - in the form of mentoring and funding - to accelerate the transition of knowledge derived from fundamental research into emerging products and services that can attract subsequent third-party funding.  [Holland, T. J., personal communication with Policy Design Lab, January 11, 2017.]

**Read more**: [Can DOD regain the technological edge?](http://www.c4isrnet.com/story/military-tech/it/2015/12/08/can-dod-regain-the-technological-edge/76994196/)

**Other agencies adapting Lean LaunchPad models with the guidance of NSF I-Corps include:**

* The **Small Business Administration (SBA)** is partnering with NSF to adapt the I-Corps program for small businesses, using the insights of “Lean Startup” methodology that challenge conventional notions of business-model planning. The SBA issued [a challenge](https://www.challenge.gov/challenge/lean-for-main-street-training-challenge/) in early 2016 for its resource partners – including [Small Business Development Centers](https://www.sba.gov/tools/local-assistance/sbdc), [Women’s Business Centers](https://www.sba.gov/tools/local-assistance/wbc), and [SCORE](https://www.score.org/) chapters – to develop an I-Corps “train-the-trainer” program. [These partners](https://www.sba.gov/content/sba-announces-winners-lean-main-street-training-challenge-0) will leverage their training to adapt and deliver, on a pilot basis, a Lean Startup training curriculum to small businesses and entrepreneurs in traditional sectors. “The Lean Startup approach has the potential to empower entrepreneurs well beyond Silicon Valley and traditional tech hubs,” said SBA Administrator Maria Contreras-Sweet. “The Lean [Startup] methodology is focused on helping entrepreneurs get the right things to the right place at the right time, while minimizing waste and maintaining flexibility. Through a partnership with the National Science Foundation’s I-Corps program, we are training and building the capacity of five of those organizations to become experts in I-Corps instruction, and we’ll work closely with them as they adapt and deliver new variations of the program to targeted audiences in their regions.”
* The **National Security Agency (NSA**) has created a version of the I-Corps curriculum specific to the Intelligence Community, and is running NSA teams through the modified course while expanding training to other partners in the intelligence community. [[Read more](http://fedscoop.com/nsa-other-feds-using-innovation-to-improve-security)]
* The **USDA’s National Institute of Food and Agriculture (NIFA)** has partnered with NSF to provide entrepreneurship training to grantees under an [Innovation Food, Agriculture, Science and Technology (I-FAST) Pilot Program](https://nifa.usda.gov/announcement/usda-nsf-announce-competition-help-small-businesses-achieve-economic-success) in order to identify valuable product opportunities that can emerge from NIFA-supported academic research.
* **The** [**DHS Science and Technology Directorate’s Small Business Innovation Research (SBIR) program**](https://www.dhs.gov/science-and-technology/sbir)has begun sending awardee entrepreneurs through I-Corps training to help them develop stronger business models, products, and services that are market-viable.[“[President Obama Announces New Commitments from Investors, Companies, Universities, and Cities to Advance Inclusive Entrepreneurship at First-Ever White House Demo Day](https://www.whitehouse.gov/the-press-office/2015/08/04/fact-sheet-president-obama-announces-new-commitments-investors-companies)”, The White House, August 4, 2015.]
* The **National Aeronautics and Space Administration (NASA),** through its SBIR/STTR program, will work with NSF to implement pilot I-Corps programs in 2017. NASA’s SBIR/STTR programs solicit research and development that is of interest to NASA’s Mission Directorates, with the goal of successfully by transitioning or infusing chosen technologies into NASA programs or outside commercial successes. The NASA I-Corps program aims to enable small businesses, including start-up firms, to increase the odds of accelerating the process of developing their SBIR/STTR developed technologies into a repeatable and scalable business model. [Directly sourced from “[I-Corps Program](http://sbir.nasa.gov/content/I-Corps)”, NASA SBIR/STTR.]

#### **Deliverable 5: Challenges to deployment / approach limitations (inc. lessons learned from agencies where implemented)**

**Key ingredients for deploying an I-Corps cohort for your agency include:**

* Adequate funding
* Balance thoughtful pilot planning with early execution
* Agency commitment to following the program structure
* Participants’ significant time investment
* Participants’ openness and adaptiveness to new ways of thinking

**Adequate funding for new programs or to support further expansion**

I-Corps requires adequate investment of agency resources to develop program models. At the same time, agencies may wish to invest in further customizing the program to better fit their particular subject area and operating environment. Even as successful I-Corps programs consider strategic expansion, programs could evaluate whether their models offer grant funding that is adequate to actually spur market commercialization and catalyze systems-level results.

**Balance thoughtful pilot planning with early execution**

The power of a well-planned and -executed pilot deserves extended consideration. Lydia McClure notes that once a pilot is launched, “Everything seems to work very well; the results come back quickly, and the results are typically very good, so then [investing in I-Corps] is pretty easy.” [McClure, L., phone interview with the Policy Design Lab, July 19, 2016.] At the same time, she reflects, “But there’s a lot of planning that happens -- and the planning can take a year or years. Sometimes there is unnecessary planning to design the best pilot possible; in some ways, which hinders the progress of the program because you can start getting results immediately by launching a pilot early, and that would probably help gather the support needed to get further financial support within each agency.” [McClure, L., phone interview with the Policy Design Lab, July 19, 2016.]

**Agency commitment to following the program structure**

“The I-Corps program is a discipline and cannot be implemented in an informal manner,” notes program director Lydia McClure. [McClure, L., phone interview with the Policy Design Lab, July 19, 2016.] I-Corps maintains quality by ensuring appropriate resources are allocated and support is provided by the National Innovation Network. In some cases – demonstrated by the [HHS Ignite Accelerator](https://www.hhs.gov/idealab/ignite-accelerator/) -- agencies may find that less formal frameworks that integrate the underlying concepts, like accelerators [crosslink] are more appropriate.

**Participant commitment**

I-Corps requires participants to commit a significant amount of time to the course. The curriculum requires full participation from research teams, and each team member must commit to in-depth preparation, attendance at webinars and workshops, as well as complete at least 15 customer discovery interviews per week. Typically this is over 15 hours per week of a commitment per person. “There’s no sitting and listening to a lecture,” explains Lydia McClure. [McClure, L., phone interview with the Policy Design Lab, July 19, 2016.] “It’s a very self-taught, experiential program, which is very hands-on. There’s a lot of getting out of the building, doing legwork yourself, coming back and talking to people with higher pattern recognition -- the instructors -- to digest what you’re learning.” [McClure, L., phone interview with the Policy Design Lab, July 19, 2016.]

**Participants’ openness and adaptiveness to new ways of thinking**

Some friction can occur when researchers receive less-than-positive feedback about their ideas. Acknowledging feedback can be difficult for some subject experts, who may bring deep technical expertise but are asked to listen with objective ears to the results of the customer discovery feedback process. Recalibrating in response to market signal can require effort. The I-Corps curriculum recognizes this, in part through its emphasis on a large number of customer interviews—through repeat exposure to customers in the field, participants learn to embrace uncomfortable truths and are given the tools to pivot, or alter course. For some, the mindset comes more easily: The "Lean Startup principle of hypothesis testing shares a kinship with the scientific method used in research and development, notes [Ralph Muehleisen](https://www.whitehouse.gov/blog/2016/07/12/progress-president-obamas-lab-market-initiative), a researcher from Argonne National Laboratory and a recent graduate of Lab-Corps [Kalil, T., “[Progress on President Obama’s “Lab to Market” Initiative](https://www.whitehouse.gov/blog/2016/07/12/progress-president-obamas-lab-market-initiative)”, The White House, July 12, 2016]Once researchers make the connection, they can see a natural fit.

**Strong support from agency leadership willingness to accept failure**

“Innovation is a high risk endeavor and while I-Corps can reduce the risk of some pathways, most innovation projects are unlikely to lead to scalable sustainable businesses. The agency has to be willing to accept, and even celebrate No-Go decisions,” says Errol Arkilic. [Arkilic, E., personal communication with the Policy Design Lab, January 5, 2017.]This tolerance for openly accepting failure is an essential part of the “intellectual honesty” that is one of the hallmarks of the program. [Arkilic, E., personal communication with the Policy Design Lab, January 5, 2017.]

#### **Deliverable 6: How-To: Steps for deploying, practices for adapting**

**How-to: Key steps for deployment**

[McClure, L., communication to the Office of Science and Technology Policy, February 2016, and McClure, L., personal communication with the Policy Design Lab, January 4, 2017.]

1. **Consensus** **agreement** **on** **desired** **outcomes**: Identify your group’s and agency’s long-term goals and preferred outcomes (e.g. Go/No-Go on commercial viability of federally funded research, scale/sustainability of promising new programs or processes, entrepreneurial mindset of constituents, culture change, etc.)
2. **Draft Memorandum of Understanding with NSF**: Whether interested in launching a commercially-driven program for STEM researchers through the I-Corps brand or looking to form Lean LaunchPad programming, NSF is able to provide advice and guidance to agencies.
3. **Curriculum** **development**: Work with similarly deployed I-Corps programs to design the optimal program in terms of time duration, expectations for teams, content delivery, and next steps. The NSF I-Corps program staff facilitated many new variants of the I-Corps program across disciplines and programs.
4. **Instructors and tools**: Programs need to identify potential instructors with the ability and will to be trained in the I-Corps methodology and to lead the program after the pilot. Additionally, to facilitate instruction and to track program outcomes, investment is needed in online software for data collection and analysis and curriculum webinars.
5. **Team** **composition and resources**: Determine which key stakeholders are critical for participation, including individuals with complementary perspectives and core strengths. At NSF, there are three team members: the entrepreneurial lead is typically a graduate or post-doctoral student, the principal investigator is a technical academic lead, and the industry mentor is a volunteer from an industry in which the project may be applied. Funding may be needed for team salary plus travel for customer discovery and event logistics.
6. **Funding** **structure** **for** **piloting and growth** **of** **programs**: Obtain funding for qualified instructors during the pilot. The expected budget is $20-25K for a single I-Corps instructor to perform the preparation and instruction of the 7-week I-Corps curriculum [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.] With the program infrastructure and teams in place, the creation of a sustainability plan for the evaluation and growth of the program is essential to testing the validity of their proposed plans using customer discovery.

[McClure, L., communication to the Office of Science and Technology Policy, February 2016, and McClure, L., personal communication with the Policy Design Lab, January 4, 2017.]

**What to look for in an effective instructor:** [Arkilic, E., personal communication with the Policy Design Lab, January 5, 2017.]

Sourcing the right instructors is perhaps the most critical element for a successful I-Corps program, and finding them can be difficult. What characteristics are most important?

1. Relentlessly Direct. Instructors must be able to be “relentlessly direct” with their teams and challenge their assumptions and data interpretations without provoking conflict or resentment.
2. Teach the process, don’t consult. Great instructors don’t provide answers, but encourage adherence to the process, even when they personally have relevant background experience: “What are you hearing from your interviews? Diagram that. Don’t tell me how you *think* it works; tell me who you talked to, and what you learned from them.”
3. Credibility. Instructors must have credibility. It’s not enough to enforce adherence to the process; participants have to believe that instructors have relevant experience and insight – otherwise, teams may wonder, “Why should I listen to this person?”
4. Command of the Classroom. The program is multi-week, multi-hour webinars, and it’s difficult to sustain teams’ engagement through that platform. Being able to read a room and make the curriculum interactive requires skill in the art of pedagogy.

#### **Deliverable 9: Future directions (“next practices as opposed to best practices”)**

At its roots, I-Corps is essentially the application of the scientific method to innovation and business development – namely, form a hypothesis, collect data (interviews), evaluate, refine hypothesis. The underlying principles can support many purposes. [Wynne, M., personal communication with Policy Design Lab, December 16, 2016.] It is important that the I-Corps approach maintain its own innovative energy and evolve while it continues its strategic expansion. Opportunities exist for programmatic expansion both before and after participation in the I-Corps curriculum. For instance, vertical scaling possibilities would extend I-Corps offerings to Phase 2 and 3 SBIR/STTR companies, while horizontal scaling opportunities could expand I-Corps to other disciplines, such as evidence-based policy [crosslink] or public safety. [Wynne, M., personal communication with Policy Design Lab, December 16, 2016.]

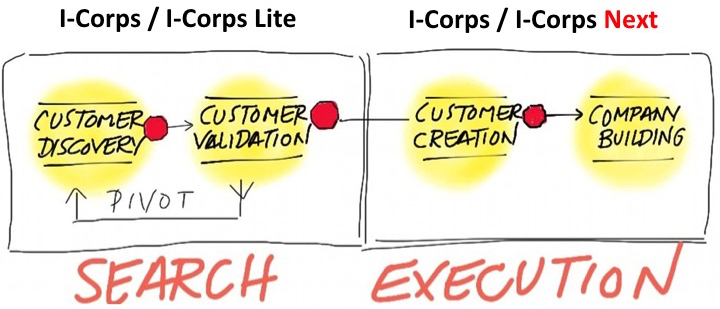
Other possibilities include:

Before I-Corps participation

One challenge many agencies have encountered in running I-Corps cohorts is that applications can be of variable quality. Introducing a “Phase 0” – a slimmed down version of I-Corps that introduces the business model canvas and customer discovery principles – could be a standalone resource for participants before they commit to a boot-camp over a longer period of time. (Currently, another potential model, [I-Corps Lite](http://www.huffingtonpost.com/steve-blank/doubling-down-on-a-good-t_b_7265300.html), is also experimenting with ways to convey value while lessening the time burden of the program.)

NSF is currently piloting two new programs, the I-Corps Lite Beat-the-Odds boot camp for SBIR/STTR Phase I recipients and a new I-Corps GO curriculum for those teams that finish the canonical I-Corps program with a solid product-market fit, but do not know how to launch an investable company.

I-Corps GO or other future variants – I-Corps “2.0” or I-Corps Next -- could differentiate further between the search for a business model and the execution of a business model – the latter of which could focus addressing “what comes next” for teams that do make a “go” decision to transition to execution. [Arkilic, E., phone interview with Policy Design Lab, December 30, 2016]. Additional training could be useful for particular niche areas -- like the life sciences – where tailored training could educate researchers on how to navigate particular regulatory landscapes on the path to market. [Wynne, M., phone interview with Policy Design Lab, September 1, 2016.] Follow-on training would be also be valuable for those researchers and scientists who face a new set of entrepreneurial challenges that come with potentially scalable startups. [Blank, S., personal communication with Policy Design Lab, January 5, 2017.] I-Corps *Next/2.0/GO would teach comp*anies how to *implement and execute* a company’s business model, emphasizing strategies to achieve liquidity and governance structures to promote commercialization: [Blank, S., personal communication with Policy Design Lab, January 5, 2017.]



[Image source: Blank, S., personal communication with Policy Design Lab, January 5, 2017.] [Permission for use]

For instance, future programming could focus on transmitting best practices in:

* *Engineering* – how to turn their science into minimum viable products and then into commercial products, how to put in place a product roadmap, the difference between custom engineering/products and scalable products
* *Sales and marketing* – how to turn lessons learned in Customer Discovery and Validation into repeatable processes for building sales and marketing programs, and organizations, basic product licensing, pricing
* *Building a company foundation* –how to create a culture for speed, urgency and agility
* *Hiring and retaining talent* – salary, equity, advisory boards
* *Legal and IP* – patent strategy, develop an understanding of legal and IP issues
* *Supply chain* – manufacturing, Clinical Research Organizations
* *Partnering* - the ability to find strategic partners in corporations and/or incubators and accelerators
* *Financing* - determining capital requirements, designing a financing strategy, securing financing. This would include angel, venture and/or strategic capital – as well as fundraising skills: pitching, demos, negotiations and managing investors
* *Liquidity* – how to best position a company for sale, merger, or IPO [Blank, S., personal communication with Policy Design Lab, January 5, 2017.]

#### **Deliverable 8: Examples of policy that have enabled or encouraged approach (legislation, exec order)**

Legislation

[S.3084 - American Innovation and Competitiveness Act](https://www.congress.gov/bill/114th-congress/senate-bill/3084), December 2016

This legislation addresses programs related to public-private partnerships and manufacturing and facilitates the future expansion of I-Corps.

[**The Stevenson*-*Wydler Technology Innovation Act of 1980**](https://www.gpo.gov/fdsys/pkg/STATUTE-94/pdf/STATUTE-94-Pg2311.pdf) (Pub.L. 96–480), as amended (codified at Title 15 of the United States Code (U.S.C.), Section 3701 *et seq*.) ([94 Stat. 2311](https://www.gpo.gov/fdsys/pkg/STATUTE-94/pdf/STATUTE-94-Pg2311.pdf))

This legislation, as the first major U.S. technology transfer law, sets forth a national policy to promote cooperation among academia, Federal laboratories, labor and industry in order to facilitate the transfer of innovative Federal technologies to United States and world markets.

* A [rule for personnel exchange](https://www.gpo.gov/fdsys/pkg/FR-2016-10-24/pdf/2016-25355.pdf) was published in October 2016, making it possible for Federal researchers to participate in startups and return without leaving Federal service. [Read more](https://www.whitehouse.gov/blog/2016/11/22/lab-market-commercializing-new-technologies-exchanging-talent) about it.

[The Bayh-Dole Act of 1980 (Patent Rights in Inventions Made with Federal Assistance)](https://www.gpo.gov/fdsys/pkg/USCODE-2011-title35/html/USCODE-2011-title35-partII-chap18.htm)

[35 U.S.C. § 200-212](http://www.law.cornell.edu/uscode/text/35/part-II/chapter-18); [37 C.F.R. Part 401](http://www.ecfr.gov/cgi-bin/text-idx?SID=801fba8be97a933ffcbd0b4064552ca0&mc=true&node=pt37.1.401&rgn=div5)

This legislation addresses intellectual property arising from federal government-funded research, and was intended to spur academic institutions to fully capitalize on transferring technology to the marketplace. [Proposed regulatory changes](https://www.federalregister.gov/documents/2016/11/07/2016-25325/rights-to-federally-funded-inventions-and-licensing-of-government-owned-inventions) to the Bayh-Dole Act (CFR 401 and 404) and the management of Federally-funded inventions is anticipated to publish in Q2 of 2017.

Policy Guidance

“[A Strategy for American Innovation](https://www.whitehouse.gov/sites/default/files/strategy_for_american_innovation_october_2015.pdf)”, National Economic Council and Office of Science and Technology Policy, October 2015.

Outline of strategic moves for furthering innovation in the United States.

#### **Deliverable 7: Online inventory of resources**

NSF holds a monthly introductory webinar to share information and answer questions about I-Corps. These webinars provide updated information about I-Corps’ curriculum as well as important dates for the program. [Find more information here.](https://www.nsf.gov/news/special_reports/i-corps/teams.jsp#webinars)

**Contact:**

Agencies interested in learning more about the I-Corps model can contact Lydia McClure, I-Corps Program Director for the National Science Foundation at [lmcclure@nsf.gov](mailto:lmcclure@nsf.gov) or 703-292-8798.

For those seeking to be connected with I-Corps community of practice, contact Ken Wright, [Kenneth\_D\_Wright@ostp.eop.gov](mailto:Kenneth_D_Wright@ostp.eop.gov) or contact Marc Wynne, [marc.wynne@cms.hhs.gov](mailto:marc.wynne@cms.hhs.gov).

In addition, primary and secondary contacts for each agency I-Corps program are:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Agency** | **Primary** |  | | | **Secondary** |  |
| NSF | Lydia McClure | [lmcclure@nsf.gov](mailto:lmcclure@nsf.gov) | | | Steve Konsek | [skonsek@nsf.gov](mailto:skonsek@nsf.gov) |
| DOE EERE | Victor Kane | [Victor.Kane@EE.Doe.Gov](mailto:Victor.Kane@EE.Doe.Gov) | | | Melanie Cornell | [Melanie.Cornell@ee.doe.gov](mailto:Melanie.Cornell@ee.doe.gov) |
| DOE ARPA-E | Nate Gorence | [Nathaniel.Gorence@Hq.Doe.Gov](mailto:Nathaniel.Gorence@Hq.Doe.Gov) | | |  |  |
| NSA | Steven Pieper | [sfpiepe@nsa.gov](mailto:sfpiepe@nsa.gov) | | |  |  |
| DHS SBIR | John Pucci | [john.pucci@hq.dhs.gov](mailto:john.pucci@hq.dhs.gov) |  | | |  |
| NIH NCI SBIR | Michael Weingarten | [weingartenm@mail.nih.gov](mailto:weingartenm@mail.nih.gov) | | Christie Canaria | | [christie.canaria@nih.gov](mailto:christie.canaria@nih.gov) |
| NIH NCATS SBIR | Lili Portilla | [portilll@mail.nih.gov](mailto:portilll@mail.nih.gov) | | David Wilde | | [WildeD@mail.nih.gov](mailto:WildeD@mail.nih.gov) |
| USDA ARS | Mojdeh Bahar | [mojdeh.bahar@ars.usda.gov](mailto:mojdeh.bahar@ars.usda.gov) | |  | |  |
| NASA SBIR | Jenn Gustetic | [jennifer.l.gustetic@nasa.gov](mailto:jennifer.l.gustetic@nasa.gov) | | Carol Lewis | | [Carol.R.Lewis@jpl.nasa.gov](mailto:Carol.R.Lewis@jpl.nasa.gov) |
| DOD ARL | Thomas Joseph (Bull) III | [thomas.j.holland8.mil@mail.mil](mailto:thomas.j.holland8.mil@mail.mil) | |  | |  |
| SBA | Matt Stevens | [Matthew.Stevens@sba.gov](mailto:Matthew.Stevens@sba.gov) | | Erika Franz | | [erika.franz@sba.gov](mailto:erika.franz@sba.gov) |
| USDA NIFA | Scott Dockum | [SDockum@nifa.usda.gov](mailto:SDockum@nifa.usda.gov) | | Charles Cleland | | [CCLELAND@nifa.usda.gov](mailto:CCLELAND@nifa.usda.gov) |

Agencies may wish to contact I-Corps Node leaders for regional LLP programming:

|  |  |  |
| --- | --- | --- |
| **Node** | **Node Leader** |  |
| DMV | Edmund Pendleton | [edmund@umd.edu](mailto:edmund@umd.edu) |
| NYCRIN | John Blaho | [John.Blaho@cuny.edu](mailto:John.Blaho@cuny.edu) |
| Georgia Tech (South) | Keith McGregor | [keith.mcgreggor@gatech.edu](mailto:keith.mcgreggor@gatech.edu) |
| Midwest | Jonathan Fay | [jpfay@umich.edu](mailto:jpfay@umich.edu) |
| Upstate NY | Tom Schryver | [tps1@cornell.edu](mailto:tps1@cornell.edu) |
| Texas | Marco Bravo | [bravo@ic2.utexas.edu](mailto:bravo@ic2.utexas.edu) |
| Bay Area | Rhonda Shrader | [rhonda\_shrader@berkeley.edu](mailto:rhonda_shrader@berkeley.edu) |
| Los Angeles | Andrea Belz | [abelz@usc.edu](mailto:abelz@usc.edu) |

**Engage:**

The [National Innovation Network (NIN)](https://venturewell.org/i-corps/nin/) is an active community of practice for I-Corps. NIN functions as a cross academic and industry network to better focus Federally-funded research and maximize resources to accelerate commercialization. [McClure, L., personal communication with the Policy Design Lab, January 4, 2017.] NIN offers nation-wide resource in best-practices for curriculum modification/delivery, mentor matching, certified I-Corps instructors, and more.

**General information on I-Corps:**

[**Video Montage**](http://www.nsf.gov/news/special_reports/i-corps/video_montage.jsp): Introducing several I-Corps Teams and their projects.

[**I-Corps Impacts**](http://www.nsf.gov/news/special_reports/i-corps/video_impacts.jsp): Team members briefly describe the I-Corps experience.

[**I-Corps Alumni Perspectives**](http://www.nsf.gov/news/special_reports/i-corps/video_alumni.jsp): Team members describe their I-Corps experiences, including their interactions with fellow team members and with their I-Corps peers, what mistakes they made, and what they will do next.

[**I-Corps in Their Own Words**](http://www.nsf.gov/news/special_reports/i-corps/video_ownwords.jsp): Team members describe the surprising things they learned from participating in I-Corps.

**Wondering more about the specifics of the I-Corps methodology**? [The curriculum is freely available](https://venturewell.org/i-corps/newfaculty/); you can peruse sample syllabi, class lectures, business canvas development tools, textbooks and supplemental readings, and additional resources. Additionally, I-Corps offers a wealth of open-source, public training resources worth watching:

1. [Pre-Planning Contacts](https://vimeo.com/groups/204136/videos/87303446) (4:34)
2. [Customer Interview Dry Runs](https://vimeo.com/groups/204136/videos/87302981) (0:49)
3. [Discovery is for Founders](https://vimeo.com/groups/204136/videos/87302891) (1:30)
4. [Pass/Fail Experiments](https://vimeo.com/groups/204136/videos/87302754) (1:32)

**Outside the Building**

* **Rules of Customer Interviews**

1. [Being Aggressive](https://vimeo.com/groups/204136/videos/87302631) (1:29)
2. [Conducting a Customer Interview](https://vimeo.com/groups/204136/videos/87302479) (1:30)
3. [Letting the Customer Interview Flow](https://vimeo.com/groups/204136/videos/87302329) (1:37)
4. [Sizing the Opportunity](https://vimeo.com/groups/204136/videos/87302172) (2:50)
5. [Finding Patterns](https://vimeo.com/groups/204136/videos/87301903) (1:50)
6. [Looking for Insights](https://vimeo.com/groups/204136/videos/87301695) (0:58)

**Early Mistakes to Avoid**

1. [Death by Demo 1](https://vimeo.com/groups/204136/videos/76390080)(2:18)
2. [Death by Demo 2](https://vimeo.com/groups/204136/videos/76172223)(1:45)
3. Understanding the Customer Problem (the wrong way) or [Death by PowerPoint](https://vimeo.com/groups/204136/videos/76171146) (1:42)
4. [Understanding the Problem](https://vimeo.com/groups/204136/videos/76173388) the right way(3:22)
5. [Multi-Person Interview](https://vimeo.com/groups/204136/videos/76175265)(2:03)
6. [Assuming You Know](https://vimeo.com/groups/204136/videos/76175907) (1:56)
7. [B-to-B to C](https://vimeo.com/groups/204136/videos/73674284)(2:15)
8. [Existing vs. New Markets](https://vimeo.com/groups/204136/videos/73674022) (5:29)
9. [Asking the Right Question](https://vimeo.com/groups/204136/videos/74338298) (2:37)
10. [Public Interviews](https://vimeo.com/groups/204136/videos/73711818) (2:11)

**Understanding What the Customer Is Telling You**

1. [Engaging the Customer](https://vimeo.com/groups/204136/videos/76174533) (3:37)
2. [Customer Empathy](https://vimeo.com/groups/204136/videos/73714461) (2:25)
3. [The Distracted Customer](https://vimeo.com/groups/204136/videos/73715398) (3:12)
4. [Customers Lie](https://vimeo.com/groups/204136/videos/76176674) (2:37)
5. [The User, the Buyer & the Saboteur](https://vimeo.com/groups/204136/videos/73673203) (2:24)

**Back in the Building**

1. [Extracting Insight from Data](https://vimeo.com/groups/204136/videos/76177502) (2:59)
2. [Pay Attention to Outliers](https://vimeo.com/groups/204136/videos/76177672)(2:16)
3. [Getting the MVP Right](https://vimeo.com/groups/204136/videos/73713162) (3:34)
4. [The “Other 85%”](https://vimeo.com/groups/204136/videos/73716009) (2:32)
5. [Finding Early Evangelists](https://vimeo.com/groups/204136/videos/87301612) (1:17)
6. [Communicating Your Discoveries](https://vimeo.com/groups/204136/videos/87313618) (2:26)

Articles

Blank, S. “[Innovation: Something Both Parties Can Agree On](https://steveblank.com/2017/01/15/23047/)”, SteveBlank.com, January 15, 2017.

Blank explores how the [American Innovation and Competitiveness Act](https://www.congress.gov/bill/114th-congress/senate-bill/3084), passed with strong bipartisan support, will support the continued expansion of I-Corps.

Wallenstein, M., “[Lessons From the Startup World](http://www.sciencemag.org/careers/2016/03/lessons-startup-world)”, Science Magazine, March 30, 2016.

A professor shares what he learned about making his research more applied and bringing it to market.

Blank, S., “[How We Changed the Way the U.S. Government Commercializes Science: Errol Arkilic — Part 1 of Episode 6 on Sirius XM Channel 111](http://www.huffingtonpost.com/steve-blank/how-we-changed-the-way-th_b_7833402.html)”, The Huffington Post, July 20, 2015.

An interview with the founding program director of NSF I-Corps.

Blank, S., “[Doubling Down on a Good Thing: The National Science Foundation’s I-Corps Lite](http://www.huffingtonpost.com/steve-blank/doubling-down-on-a-good-t_b_7265300.html)”, The Huffington Post, May 12, 2015.

Introduction to the I-Corps Lite program.

Ledford, H., “[Biotech Boot Camp](http://www.nature.com/news/biotech-boot-camp-1.17178)”, Nature, March 25, 2015.

An in-depth look at the experience of going through the I-Corps curriculum.

Kane, N., “[A Bright Idea: Teaching Educators To Be Entrepreneurs](http://www.forbes.com/sites/neilkane/2015/01/23/a-bright-idea-teaching-educators-to-be-entrepreneurs/#5093f1e74b42)”, Forbes, January 23, 2015.

An overview of how the I-Corps program came together at NSF.

“[I-Corps Moves Research From Lab to Market](http://uwm.edu/researchreport/entrepreneurship-leadership/light-i-corps/)”, University of Wisconsin Milwaukee.

Scientist Janis Ellis, an I-Corps graduate, seeks to bring her latest research to market.

Chowdhry, A., “[Michigan I-Corps Program In Ann Arbor Begins Today](http://www.forbes.com/sites/amitchowdhry/2013/05/07/michigan-i-corps-program-in-ann-arbor-begins-today/#7ad2e061423a)”, Forbes, May 7, 2013.

Introduction to the I-Corps program in Ann Arbor.

**Other Lean Startup Resources,** [**as recommended by NSF I-Corps**](https://www.nsf.gov/news/special_reports/i-corps/resources.jsp)**:**

[Blank, Steven](http://steveblank.com/). *The Four Steps to the Epiphany*. 2005.  
Provides step-by-step strategy for any new company or product.

[Blank, S. and Dorf, B.](https://steveblank.com/), *The Startup Owner's Manual:* *The Step-By-Step Guide for Building a Great Company. 2012.*  
Describes each stage of the customer development process.

Constable, G.,”[*12 Tips for Customer Development Interviews*](http://giffconstable.com/2011/07/12-tips-for-customer-development-interviews-revised/)*” (revised)*, July 2011.  
Covers how to conduct meaningful interviews and understand the feedback given.

Kim, W. C. and Mauborgne, R[.](https://www.nsf.gov/cgi-bin/good-bye?http://www.blueoceanstrategy.com/) [*The Blue Ocean Strategy*](http://www.blueoceanstrategy.com/). 2005.  
Reviews how to create and capture untapped markets.

Livingston, J., [*Founders at Work: Stories of Startups' Early Days*](http://www.foundersatwork.com/)*.* 2007.  
Through interviews with founders of famous technology companies, this book demonstrates what makes a startup successful.

 ”[*Assessing the Impacts of Changes in the Information Technology R&D Ecosystem: Retaining Leadership in an Increasingly Global Environment*](http://www.nap.edu/catalog/12174/assessing-the-impacts-of-changes-in-the-information-technology-rd-ecosystem)*”*, National Research Council*,* 2009.  
Chapter 1 describes the innovation ecosystem for the information technology sector.

Osterwalder, A. and Pigneur Y., [*Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. 2010.*](http://www.businessmodelgeneration.com/canvas/bmc)Discusses how to create, examine, refine, and implement successful business models.

Pincus, M.,. ”[*Quick and Frequent Product Testing and Assessment*](http://ecorner.stanford.edu/videos/2313/Quick-and-Frequent-Product-Testing-and-Assessment)*”*, October 2009.  
Overview of how to conduct rapid product testing and assessment to gauge consumer interest and to test and improve multiple products simultaneously.

**Annex of Interviews:**

Errol Arkilic

Steve Blank

Dean Chang

Read Holman

Lydia McClure  
Marc Wynne

Additional Reviewers:

Jennifer Erickson

Ken Wright

I-Corps Program Managers:

Lili Portilla (NIH/NCATS)

Christie Canaria (NIH/NCI)

Mojdeh Bahar (USDA)

Thomas Joseph (Bull) Holland (DOD)

Jenn Gustetic (NASA)